

# 60<sup>th</sup> Annual Road Builders' Clinic

## Utah Accelerated Bridge Construction “Moving Forward At 1 MPH”



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# Presentation Overview

## The ABC Journey

- Why Use Accelerated Bridge Construction ?
- History & Economics of ABC
- What we did BEFORE the 1<sup>st</sup> ABC project
- What we did DURING the 1<sup>st</sup> ABC project
- What we've done since the 1<sup>st</sup> ABC project

# WHY ABC ?



# Family of APC (Accelerated Project Construction)

- Over the past decade, several contracting methods have been introduced in Utah:
  - A+B Bidding (cost incentive).
  - Lane Rental (cost incentive).
  - Design Build (innovation).
  - CMGC (innovation + risk).
- ABC is the next step in an ongoing culture within UDOT to minimize construction impacts.

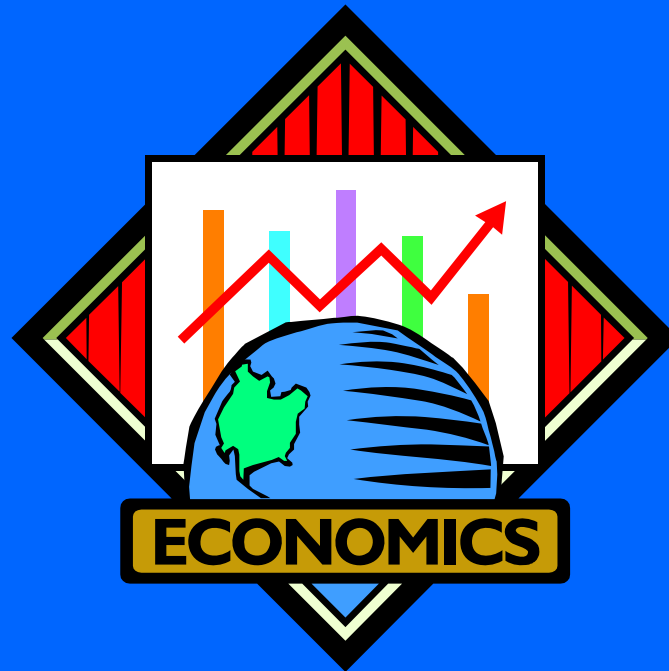




# Benefits of Using ABC

- Reduce **TRAFFIC** impacts (shorter schedules, limited detours, off peak work)
- Improve **SAFETY** to workers and public (reduced exposure time and off site construction).
- Improve **QUALITY** (controlled cures and construction without traffic).
- **COSTS** savings (user costs, increased durability, reduced traffic control, more \$\$ going to direct construction).
- Reduced **ECONOMIC** & Business impacts from delays.
- Reduced **CONSTRUCTION SEASON**, and 1 years inflation (7% estimate).
- Reduced **ENVIRONMENTAL** impacts (footprint, air quality).

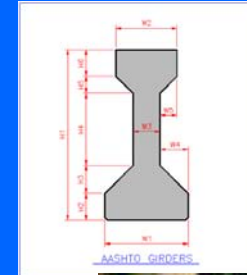
# History and Economics of using ABC ?



# Progression of ABC (Accelerated Bridge Construction)

## Past

- Precast AASHTO Girders
- Precast Culverts
- Precast Noise/Retaining Walls



## Future

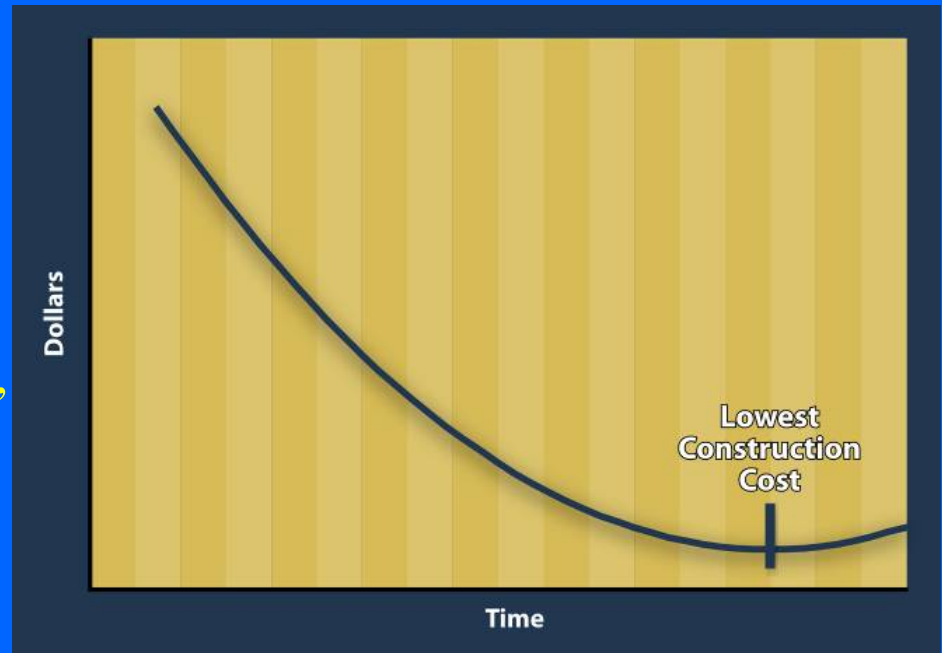
- Precast Deck Panels
- Precast Piers
- Heavy Lift (SPMT)
- Specialty Materials
- Standards



# ECONOMICS

## Tradition Cost Optimization

- Contractors want to choose a construction time that minimizes their costs.
- Optimal costs and schedule are usually driven by available labor, equipment and workloads not how fast they can do the job.
- User costs are NOT considered in a traditional bid format.

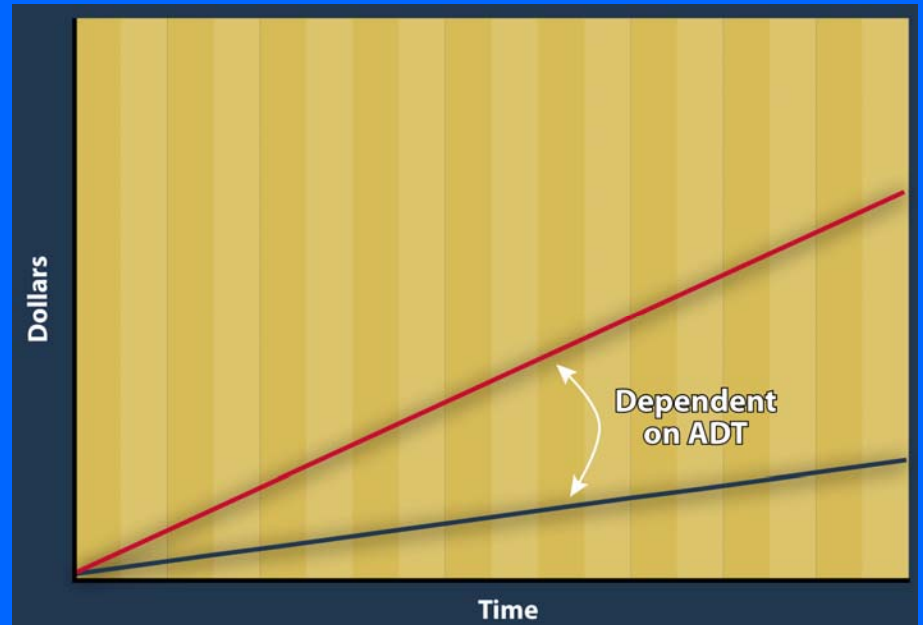




# ECONOMICS

## User Costs

- User costs to public increase with time.
- Impacts include: economic loss, time wasted in traffic, business impacts, fuel costs, etc.
- With traditional bidding and construction, the contractor does not share in user costs.

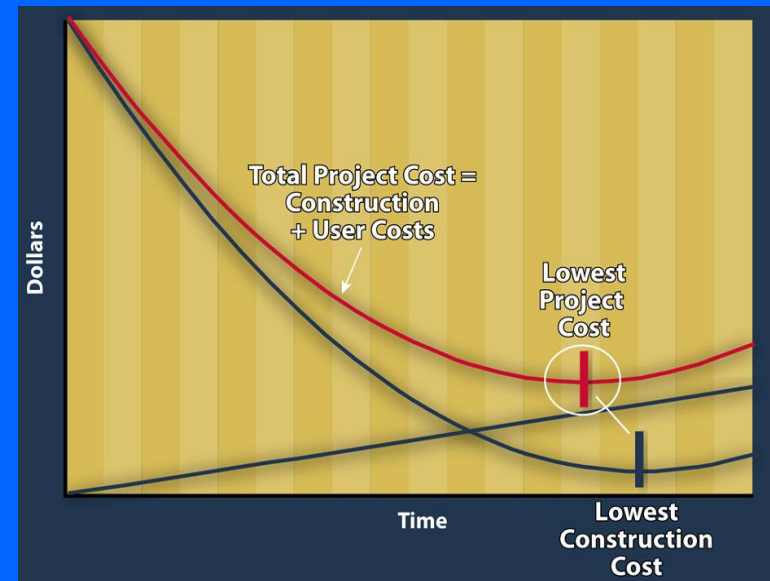




# ECONOMICS

## Total Cost (Construction + User)

- Combining user costs with direct costs reduces the optimal time to construct.
- Including User Costs shifts incentive from lowest cost to contractor to lowest cost to everyone.





# New Paradigm

From

“Lowest Construction Cost”

to

“Lowest Project Cost”



# Introducing New Ideas

## “Change is Inevitable, Misery is Optional”

- Went on scan tours to visit other successful projects.
- Change requires a Champion
- Expect highest resistance from within (contractors, designers) not public or external.
- Requires technical acceptance that new technology will work.
- Requires acceptance that initial higher cost will add long term value.
- Requires “targeted messaging” to public, media and politicians.
- First pilot project has to be successful.
- Decision tree/when to use ABC



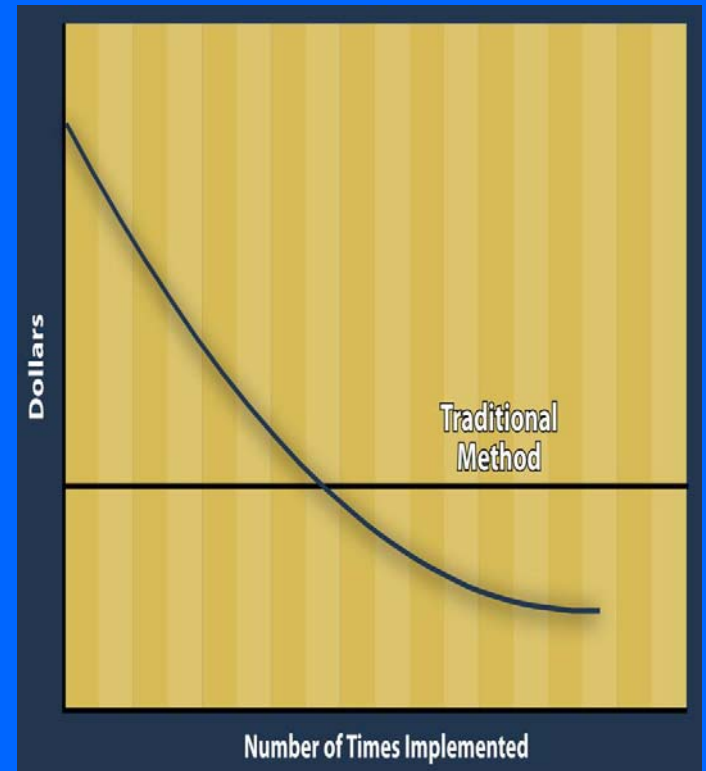




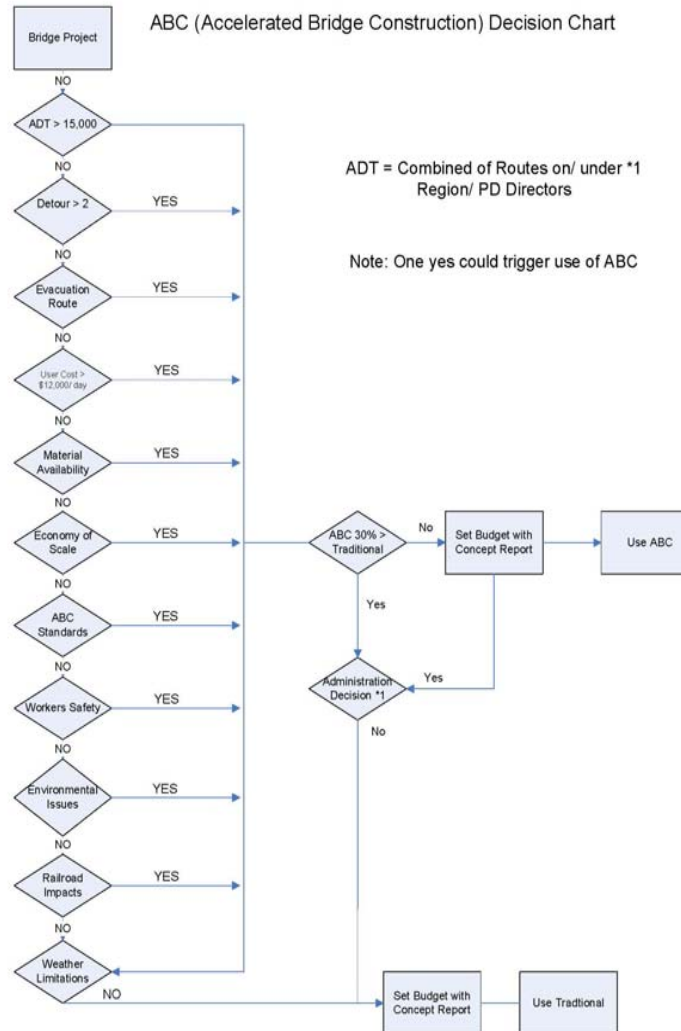
# Cost of New Technology

## “Economy of Scale – Mass Production”

- Cost to produce declines as the quantity produced increases.
- Time to produce also declines with experience and standardization.
- Examples: cars, computers, digital cameras, flat screen TV, AASHTO beams CADD, bolts/rivets, etc.
- Requires early investment at higher cost, with long term cost savings as technology is accepted as standard practice.



# ABC Decision Tree



# BEFORE

## Our 1<sup>st</sup> SPMT Move



# What are SPMT's ?

- “Self Propelled Modular Transports”
- Multiple Axles Lines of Independently Steered Bogies
- A 360° Turning Capacity for each Bogie
- Lifting Capacity of 25,000 pounds per axle
- Historically used in many other industries, including maritime transport.





# SPMT History

- 1<sup>st</sup> SPMT Project (I-215 at 45<sup>th</sup> South) completed in 1 weekend during 2007
- 12 Additional SPMT Projects completed in 2008.
- ABC used as standard practice for future projects.



# Funding & Coordination

- Obtained \$1 M of special funding from Highways for Life (HFL) as seed money to implement new technology (SPMT).
- Worked with Project Managers to offset reluctance of new technology.
- Set up tracking costs of new technology over time in comparison to traditional methods.



# Planning Ahead

- Animation to explain technology
- Apply Lessons Learned from Precast Deck Projects
- Applied Lessons Learned from Scanning Tours to other /States.
- Meetings with SMPT equipment suppliers (Mammoet).
- Used 2007 AASHTO Bridge Conference to share technology.
- Success in getting \$1 Million Highways for Life funding.
- Held workshops with contractors & designers.





# Who is Our Customer ?

- General Public
- Trucking Industry
- Political (Legislature)
- Surrounding businesses
- Schools, special facilities, residents
- Emergency Services
- Media
- Contractors and Consultants





# Customer Needs

- Functional use
- Safety
- Minimize impacts to local businesses
- Access for schools, emergency services, etc
- Reduce delays from construction
- Keep public informed to allow them to make decisions
- Minimize impacts to economy.
- Provide Value



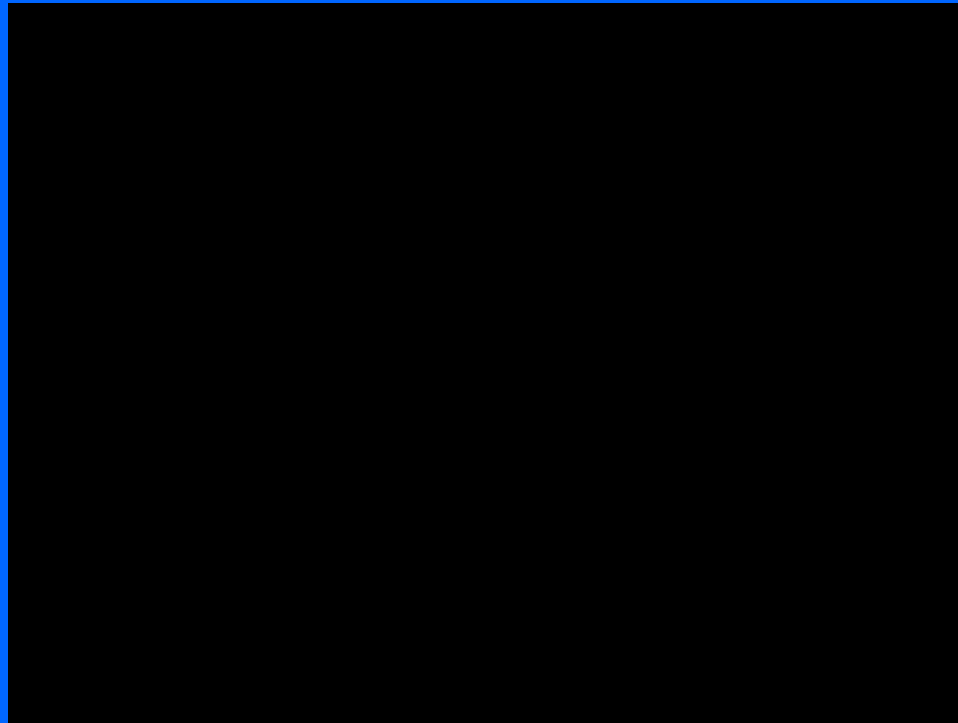
# Lessons Learned Precast Deck Projects

- Survey for Fit (horizontal, vertical, etc)
- Deflection affecting fit
- Composite Action with Girders
- Concerns with Seismic performance
- Extra Rebar for lifting
- Quality of Concrete is Better
- Worker Safety improved



# Video Animation

- Released 2 weeks prior to move
- Messaging for media and public



# 1<sup>st</sup> SPMT Project in Utah

## I-215 @ 4500 South

- Existing bridge had severe deterioration of beam ends, columns.
- Deck 4, Sub 2, Super 4 (NBIS)
- Temporary shoring installed
- Sufficiency rating = 40
- Crosses I-215 Urban setting







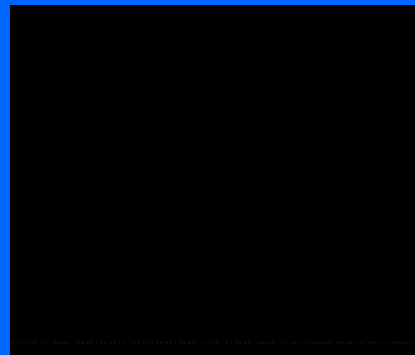
# What we did DURING the Move

- Round the Clock People on Site
- Contingency and Communication Plans
- Celebrate & Promote Success and Benefits
- Openly spoke of the cost of the technology and benefits of the new technology.
- Public Involvement and Crowd Control
- Media Coverage & Messaging
- Invited surrounding states to come and learn, holding workshops to transfer technology & exchange ideas.
- Involved other State DOT's, FHWA, Contractors



# Messaging to Media & Public

- Anticipated people would come, and media would cover.
- Developed Messaging to tell “our” story, not theirs.
- Developed contingency plans.
- Developed and distributed flyers, press releases, etc.
- Developed animation video to explain use of new technology.
- Created public observation areas & crowd control.



# What We Have Done Since Our 1<sup>st</sup> Move

- Technology Transfer
- Monitoring the move
- Create Standards
- Program to do ABC not by project
- Scanning Tours and Presentations to other States.
- Held Workshops with industry
- Developed ABC Flowchart





# Bridge Instrumentation

## Goals of Instrumentation

- Initial monitor during the move, stay with elastic limits of design.
- Future designs
  - Better designers
  - Reduce deflection/cracking
  - More economical design to utilize ABC
- Performance for Long Term





# Successful Pilot Project Led To:

- Success led to use of SPMT on 12 additional bridges in 2008, and development of ABC standards.



# Lessons Learned

## I-80, State to 1300 East

### 7 Bridges Moved

#### “1300 East Bridge Garden”

- 7 bridges built along I-80 westbound corridor.
- Constructed off-site then moved into place using SPMT.



#### ABC Method

- Skid Rails and Climbing Jacks
- SPMT
- User Savings: \$4,000,000





# I-80 Parleys Canyon Lessons Learned

- Contractor chose to build new bridges on supports next to existing bridges, allowing visualization of fit.
- Complex geometry, 6% grade with super-elevation. Building next to existing bridges helped to visualize fit.
- Coordination with events (concerts, arts festival, etc) in Park City.
- User Savings: \$5,354,447



# I-215 @ 3300 East

## Lessons Learned

### Design Construction

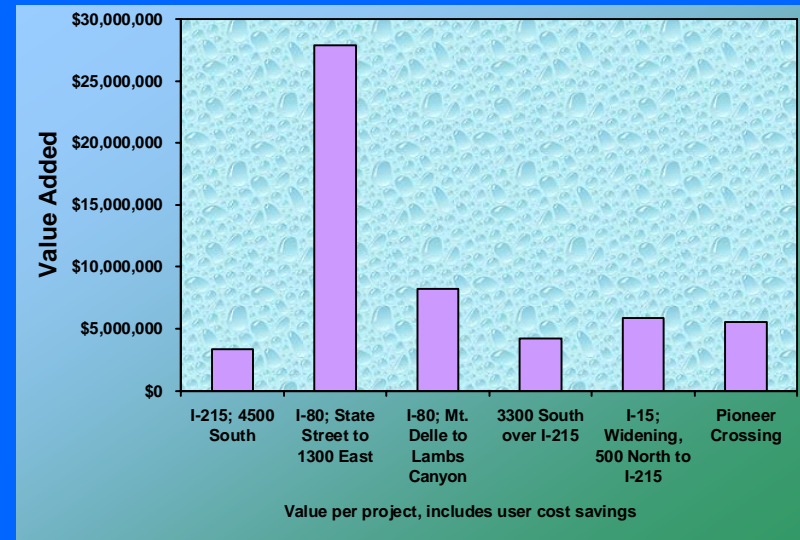
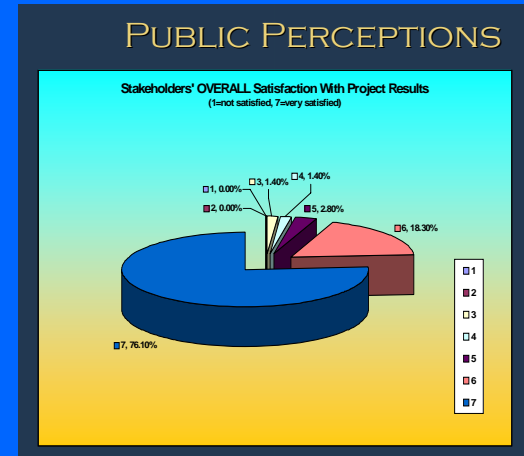
- Utility conflicts under travel path (gas & water)
- Lightweight aggregate reduced number of SPMT's used.
- Traditional demolition of existing bridge took longer than if SPMT's had been used.
- Public involvement a success (school art, media messaging, spectator areas).
- User Savings: \$4,000,000





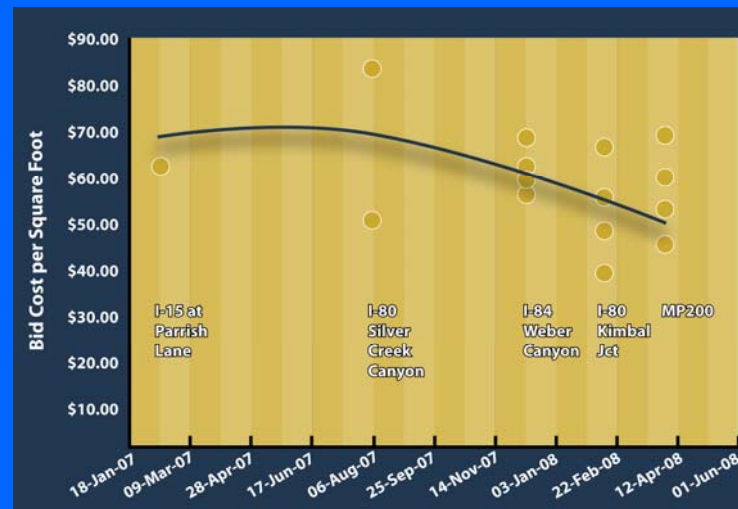
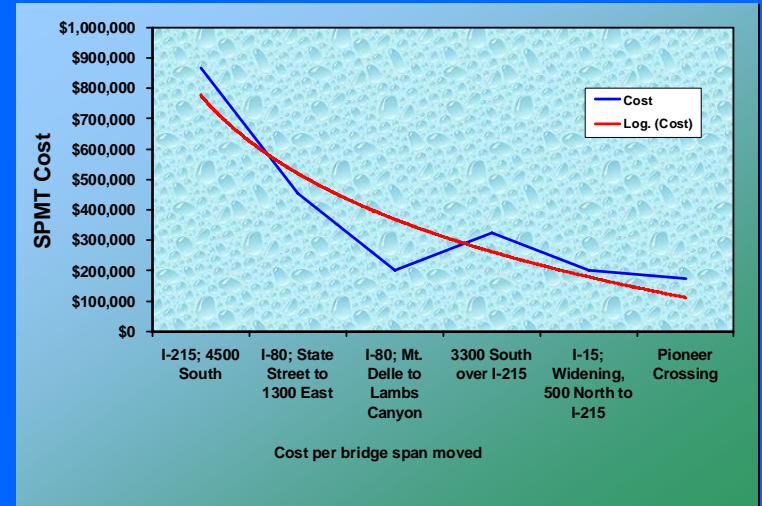
# Results

- Public Opinion Polls have increased with projects.
- User costs reduced by approx. \$ 4 Million per project.
- Road closure reduced to 2 days versus 6-9 months.



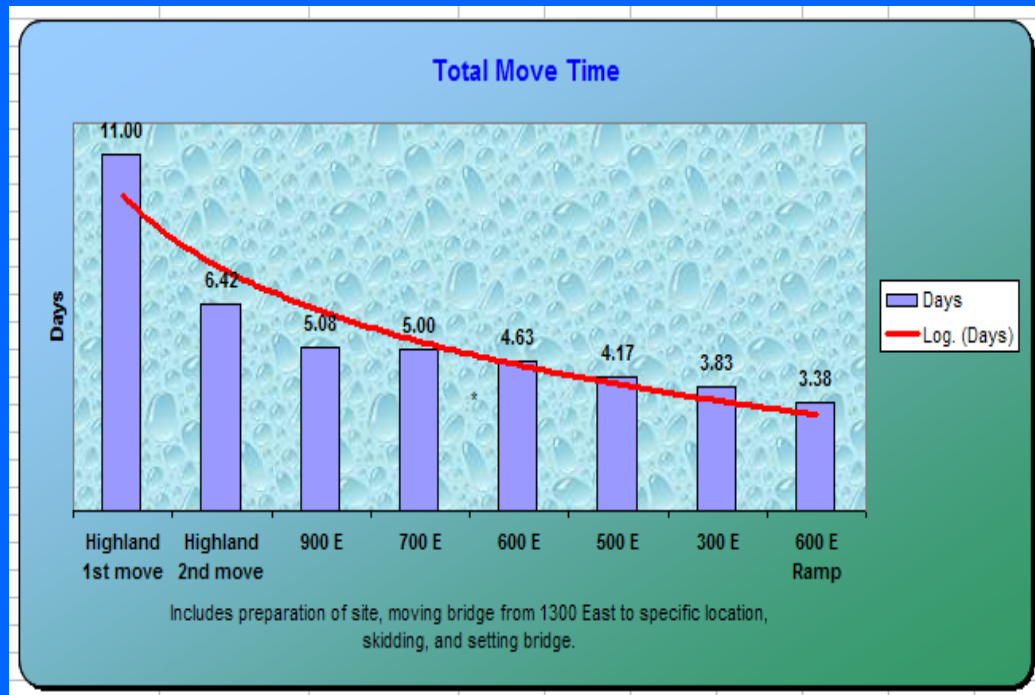
# Results

- Cost declining with more projects and experience.



# Utah Experience

## Getting Better With Time







# White Paper on Design Savings for Bulb Tee

- “Investment in (bulb tee) standards can be recouped in 8 bridge designs”
- “The cost benefit for 30 bridges is approximately 4:1”
- <http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:2092>,



# Things We Do To Sustain ABC

- Program of Projects
- Incorporate into our Process
  - New Committees
  - Standards
- Change in Paradigm



# Awards

UDOT has won multiple awards for implementation of ABC in Utah. These awards include:

- The 2009 ACEC Merit Award for studies and Research

2008 IRF Global Road Achievement Award for Construction Methodologies

- 2008 NPHQ Award for Making A Difference Gold Award for Breaking The Mold

- 2008 Governor's Award for Excellence in Innovations and Efficiency

- 2008 Best of State Award for Science and Technology



# Questions

This presentation can be found at:  
<http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:1991>,